



The MRS

MODEL OF RESILIENCE IN SITUATION

Pierre LE BOT

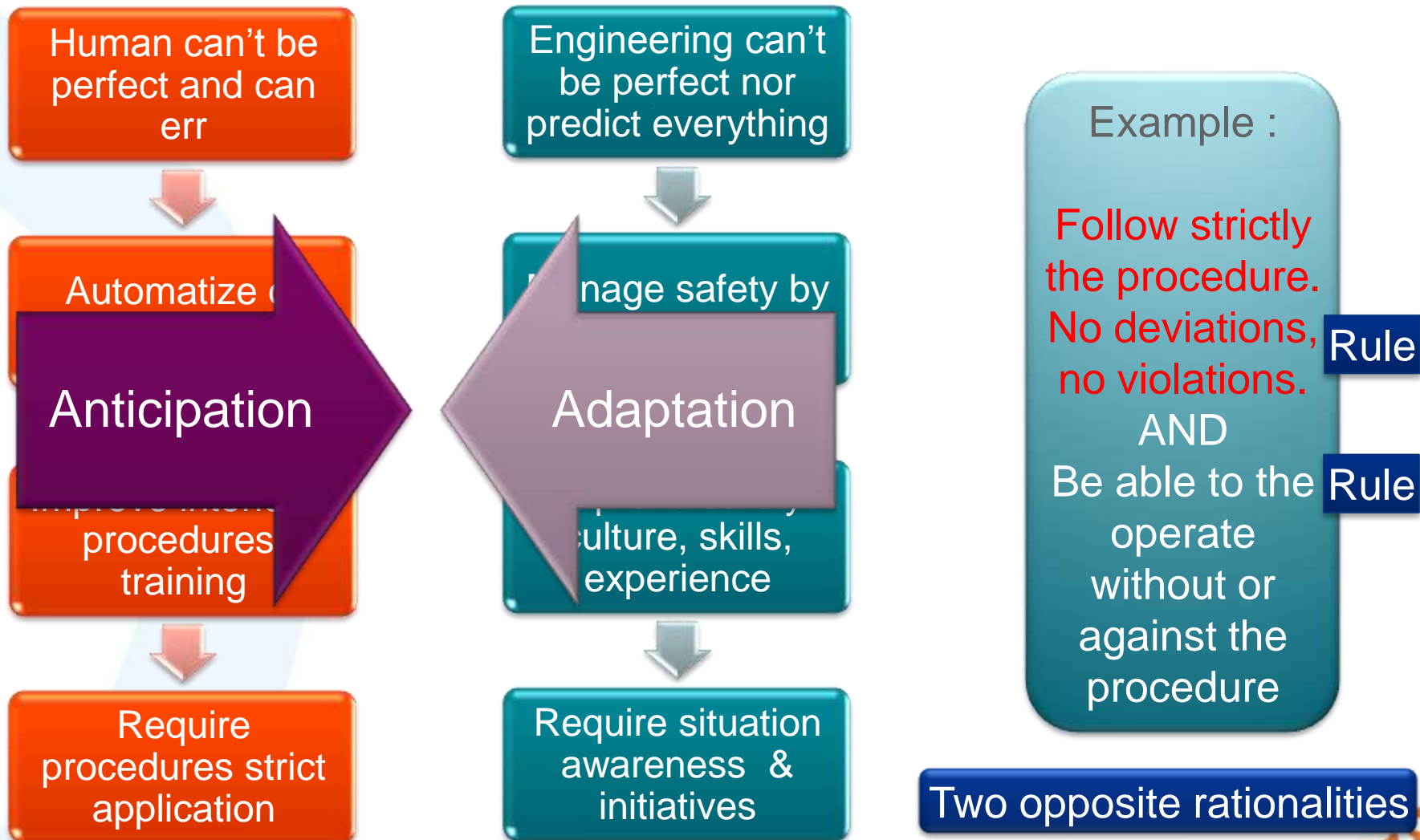
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Clamart, France*



TWO RATIONALITIES ARE NECESSARY TO BE SAFE

EDF R&D

Ultra safe systems: Humans role in safety





How to combine two opposite rationalities ?

- ◎ In other terms: how to combine opposite rules without being only robust (by anticipation) or flexible (by adaptation) ?
 - By alternating dynamically two phases:
 - Stable phase: following the rules
 - Reconfiguration phase: producing rules
 - By producing rules:
 - That combine the two rationalities
 - Adapted to the situation
 - In the situation
 - That are temporary
- ◎ How to be able to produce rules in that way ?
 - With an organisation that have specific abilities and functions
 - ➔ MODEL OF RESILIENCE IN SITUATION (MRS)



Control
regulation

Control
Heteronomous
rules

- Prescription
- Training
- Safety culture

Autonomous
regulation

Autonomy

- Autonomous rules
- Experience
- Skills and routines

Effective
operating
rules

Joint
regulation

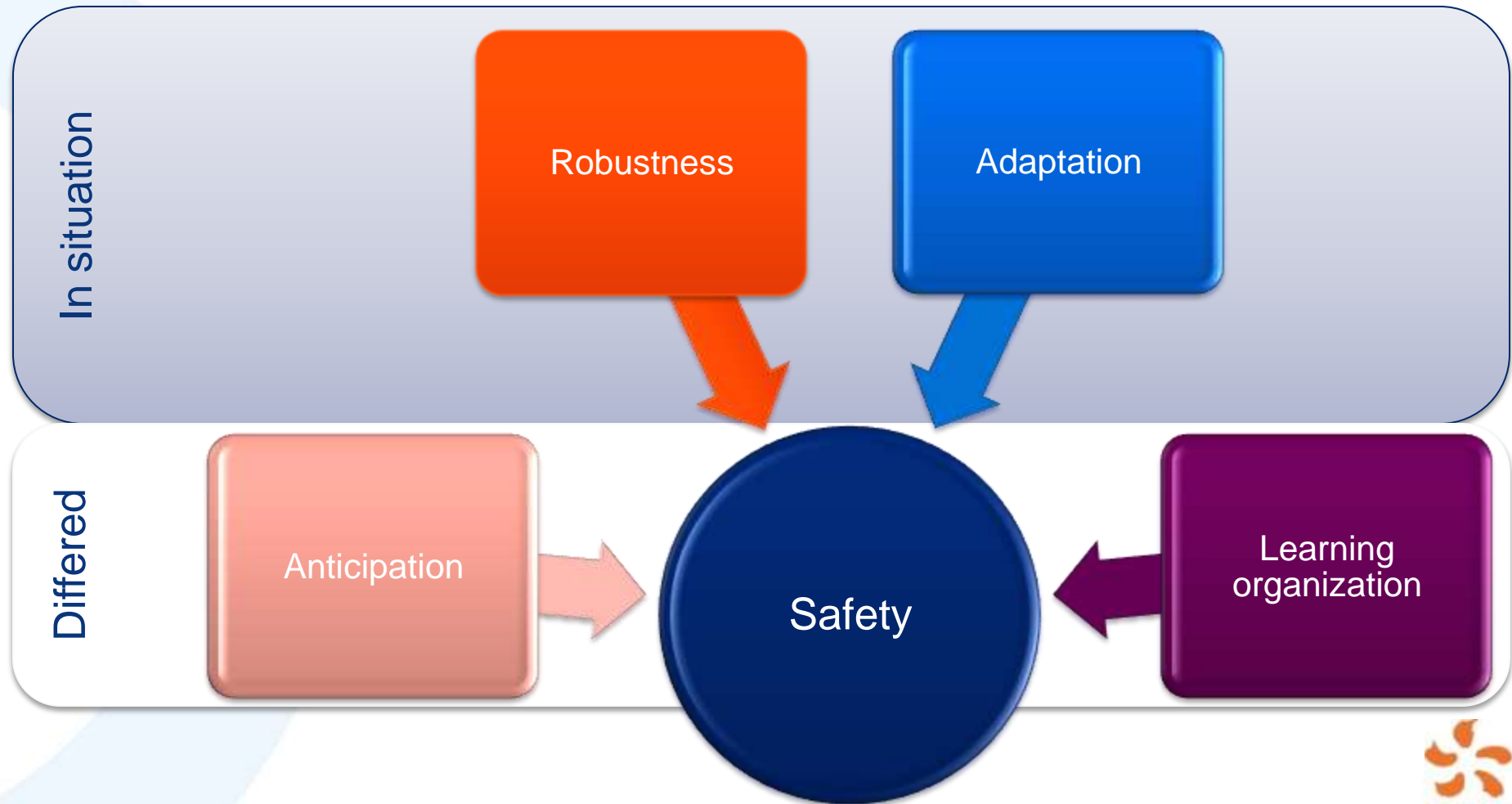
Two rationalities are
necessary

(from J.D. Reynaud)

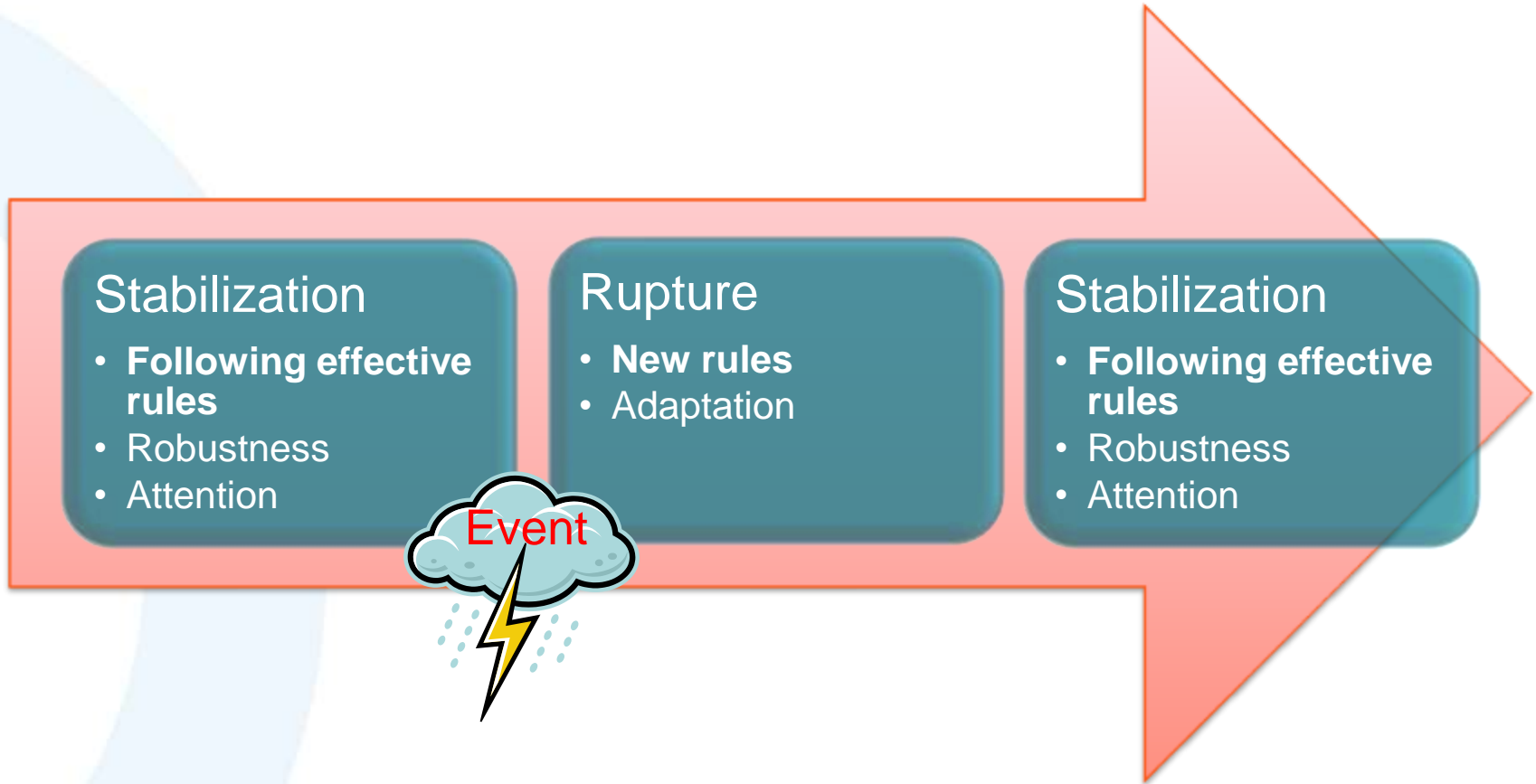
Effective rules:

- Collective
- Sensemaking
- Formal or informal
- Contextual and temporary

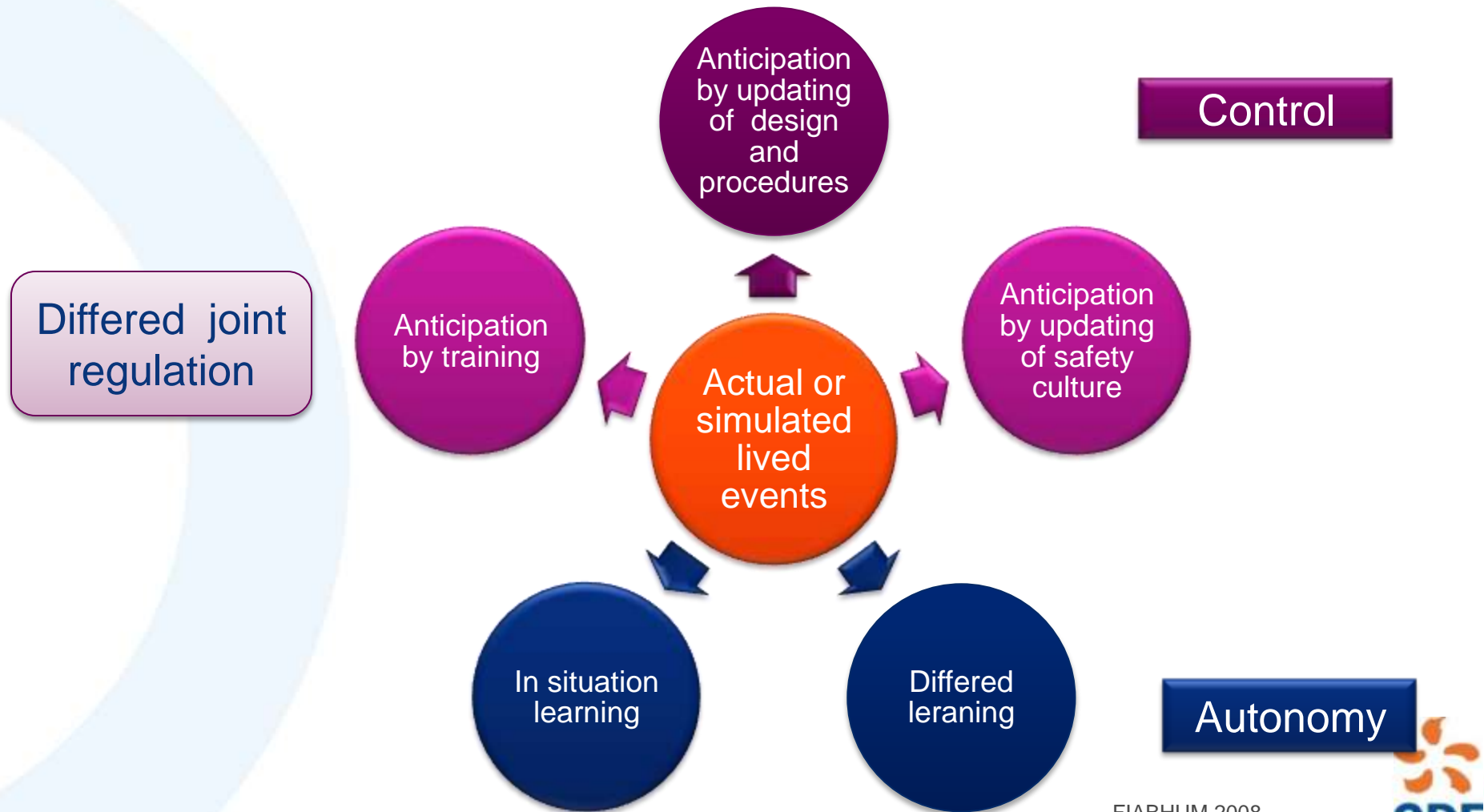
Safety by resilience



Alternate stability and rupture



Learning from events to anticipate and develop autonomy

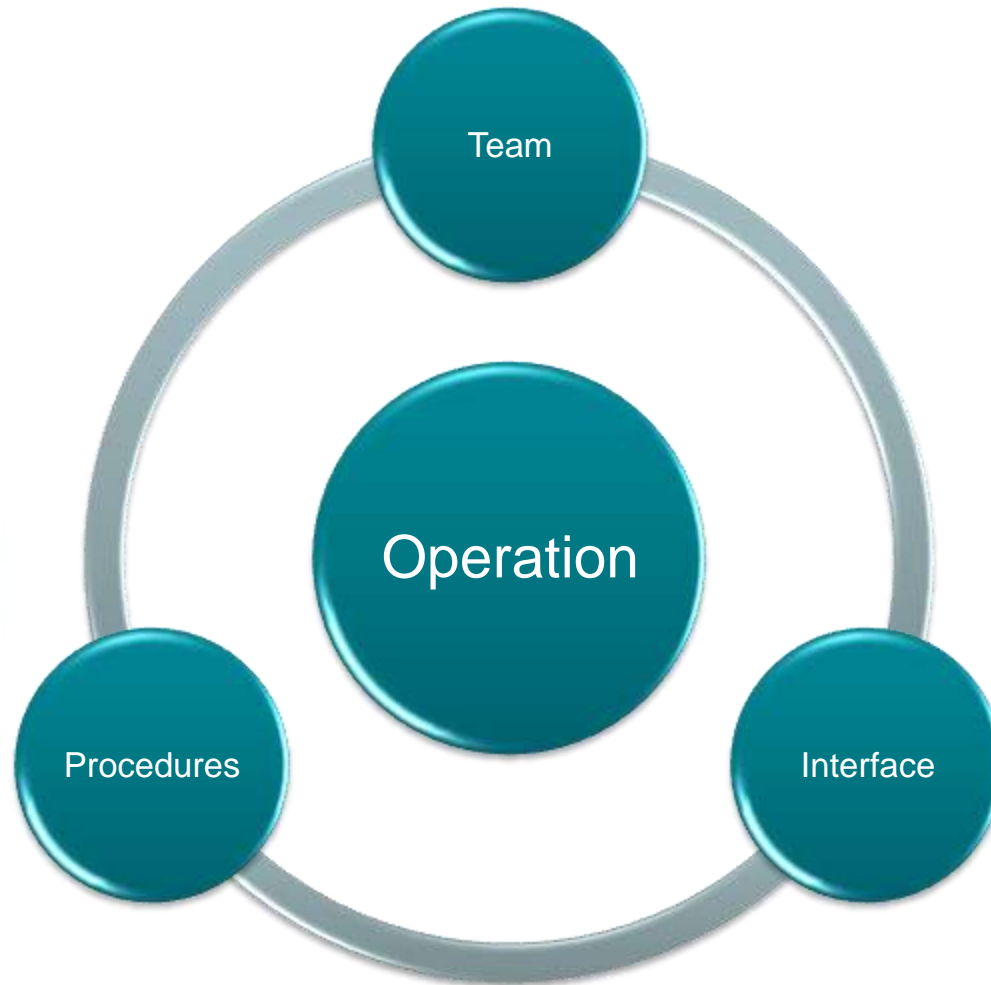




Following effective rules :
keeping the course

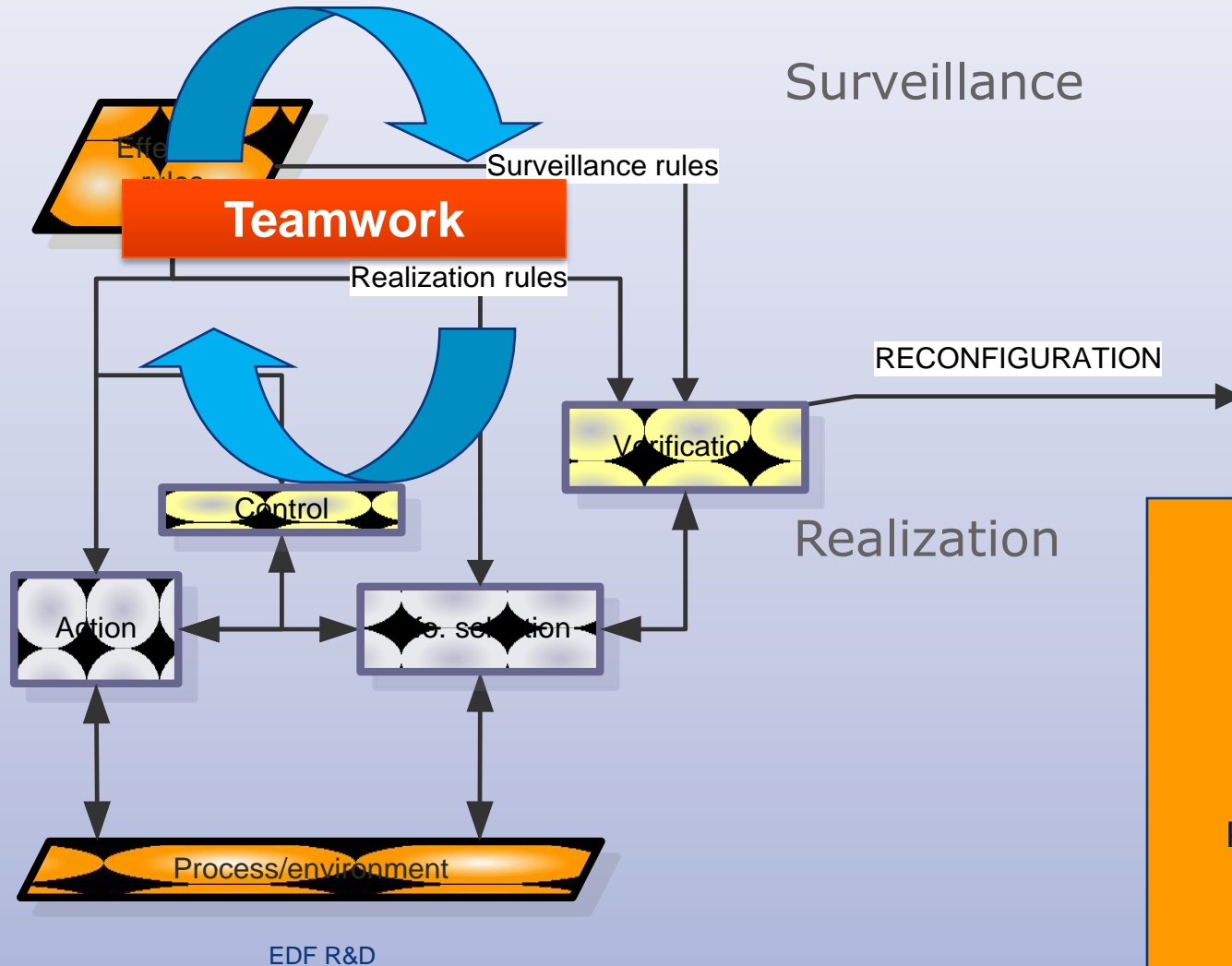
ROBUSTNESS (AND ATTENTION)

Emergency Operating System



Following the effective rules

Robustness and attention in stable phase



Rules :

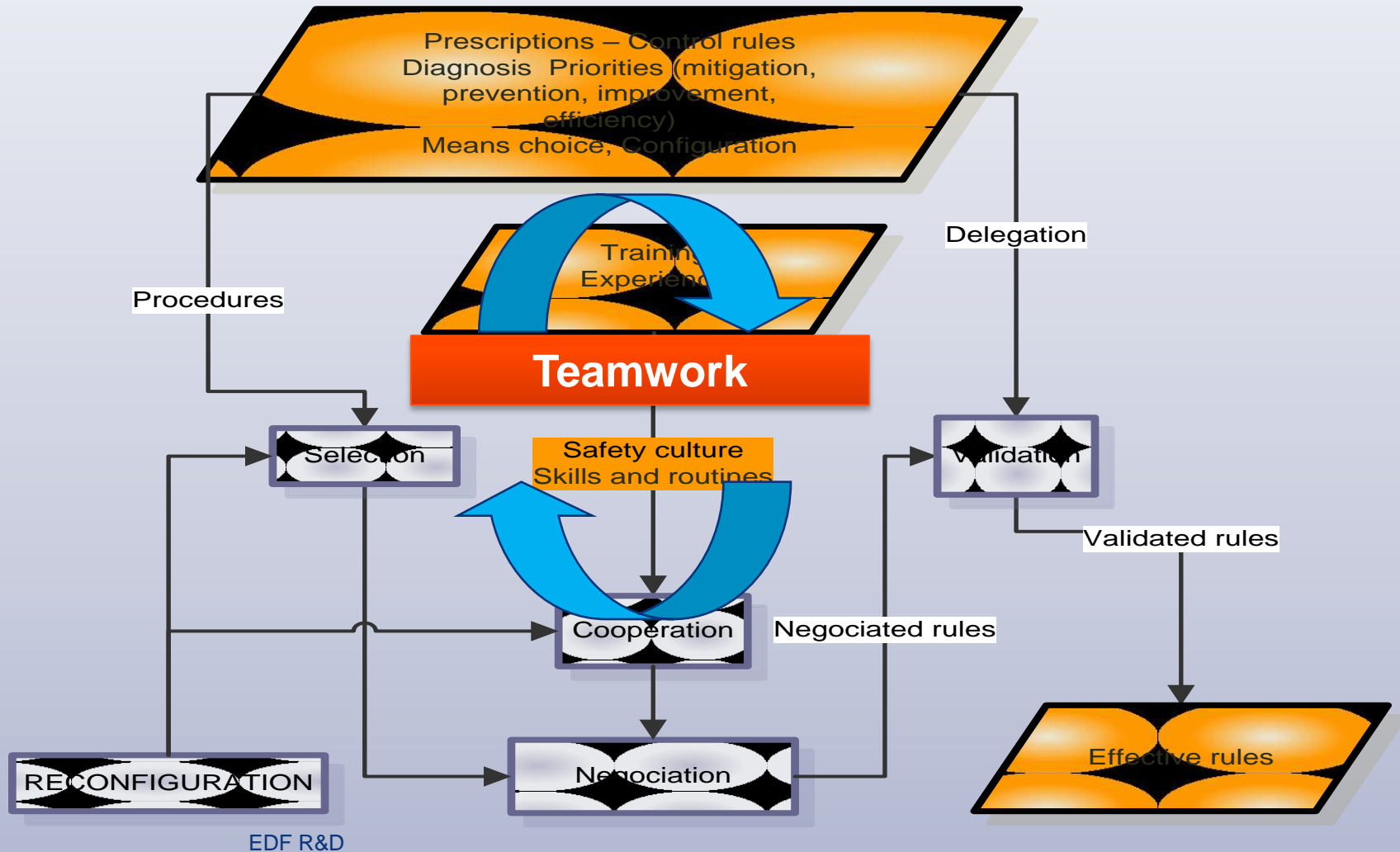
- Diagnosis
- Objectives
- Mitigation
- Prevention
- Improvement
- Efficiency
- Priority of objectives
- Means choice
- Configuration
- Surveillance criteria

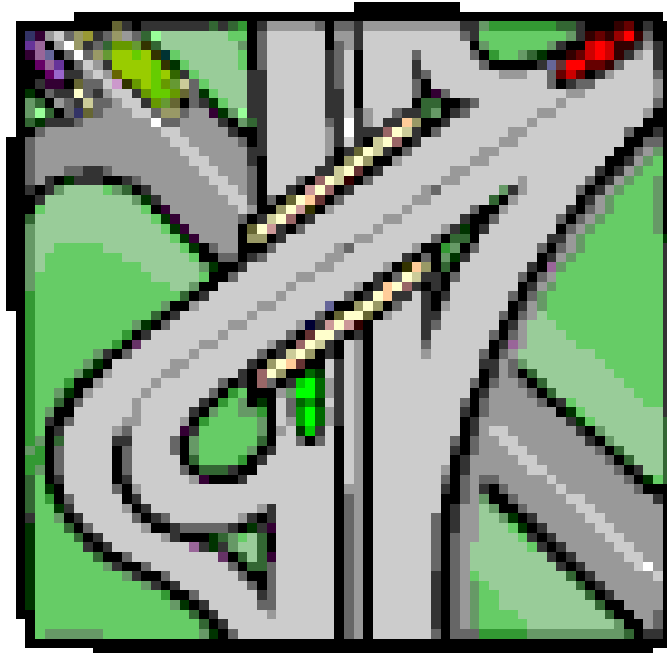


ADAPTATION

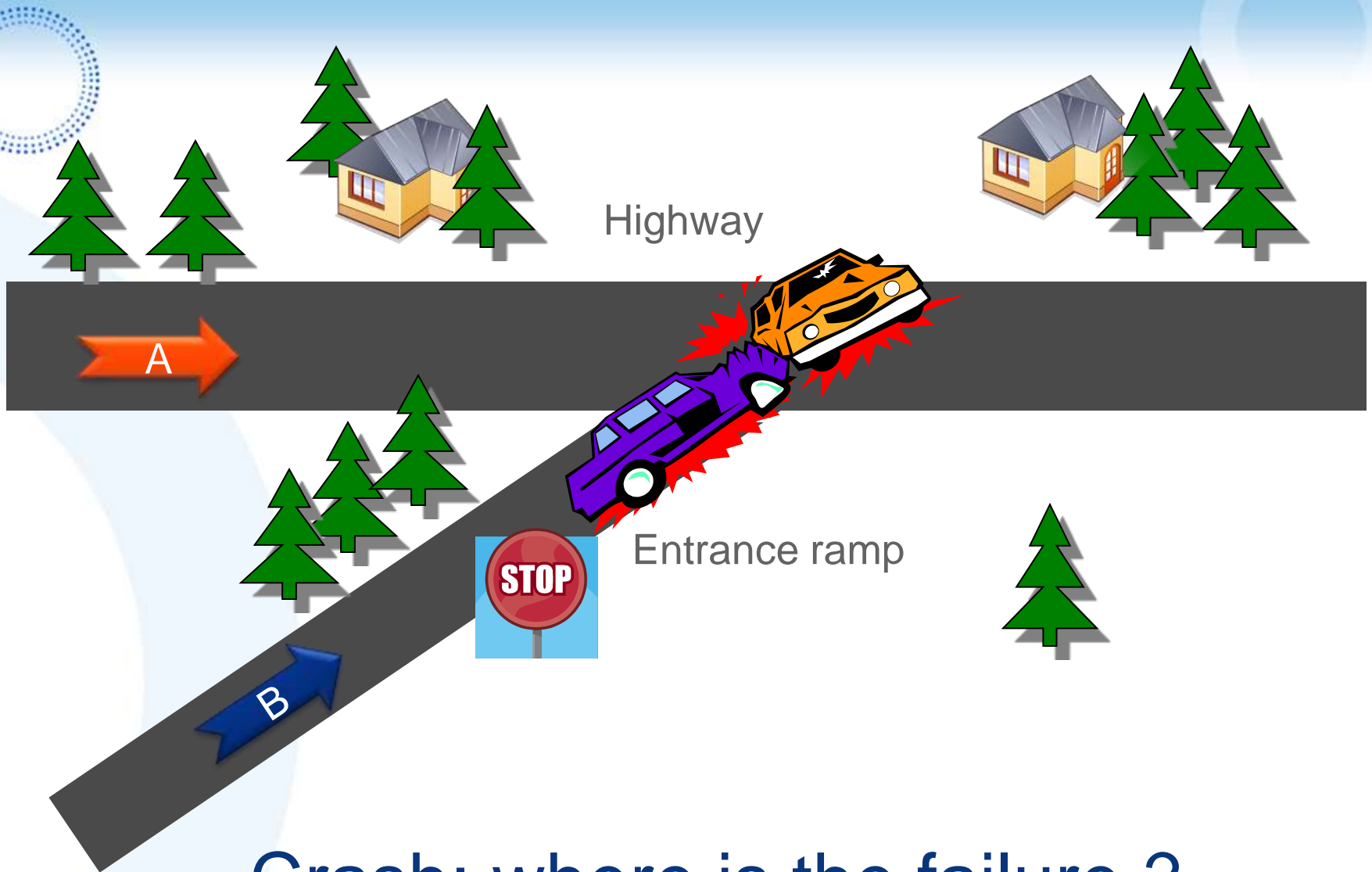
To adapt the rules : to change the course

In situation joint regulation





EXAMPLE



Crash: where is the failure ?



An unsafe system

Traffic Jam on A

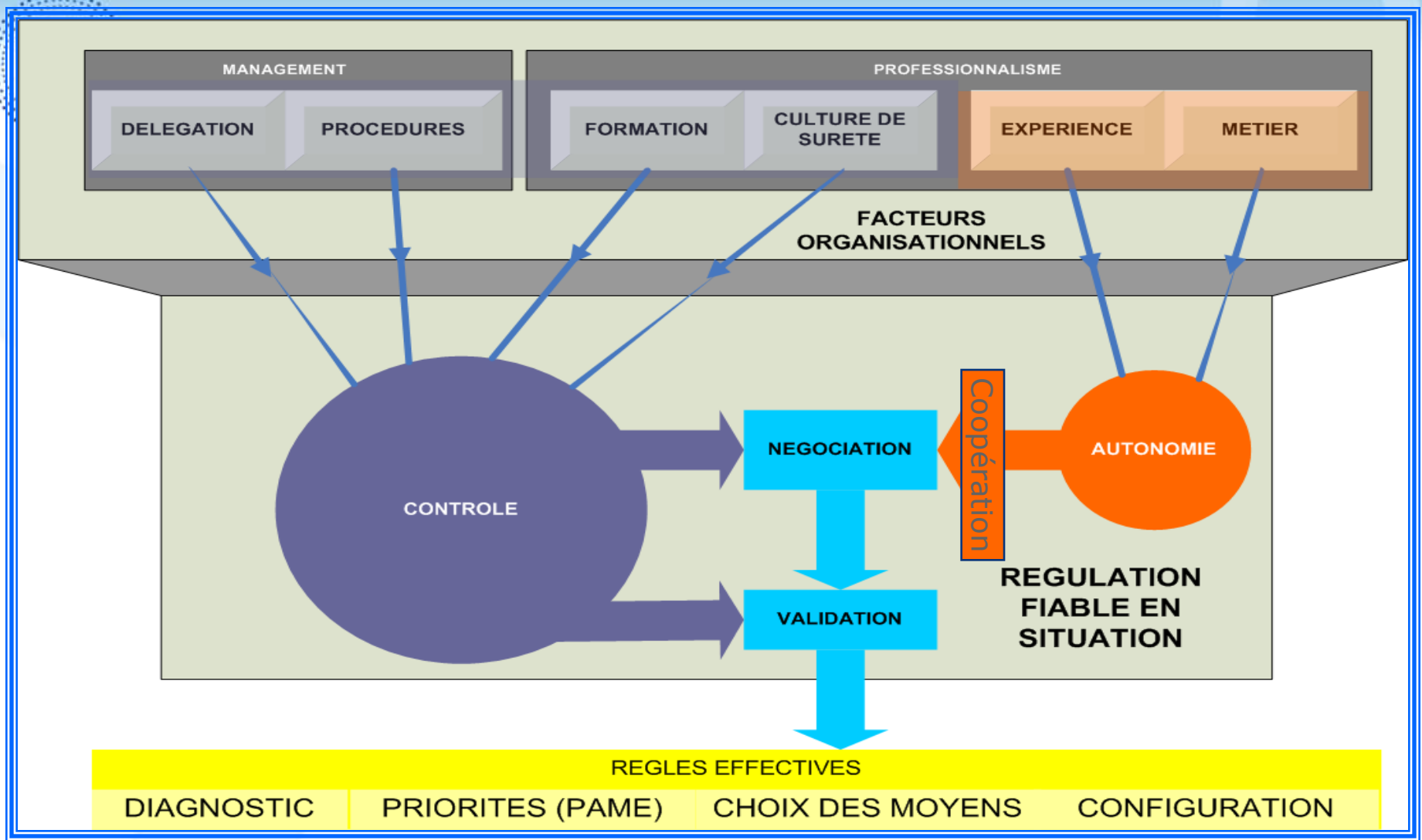
- Slowdown on A
- Slowdown on B until full stop
- Impossible to enter A from B

New rule

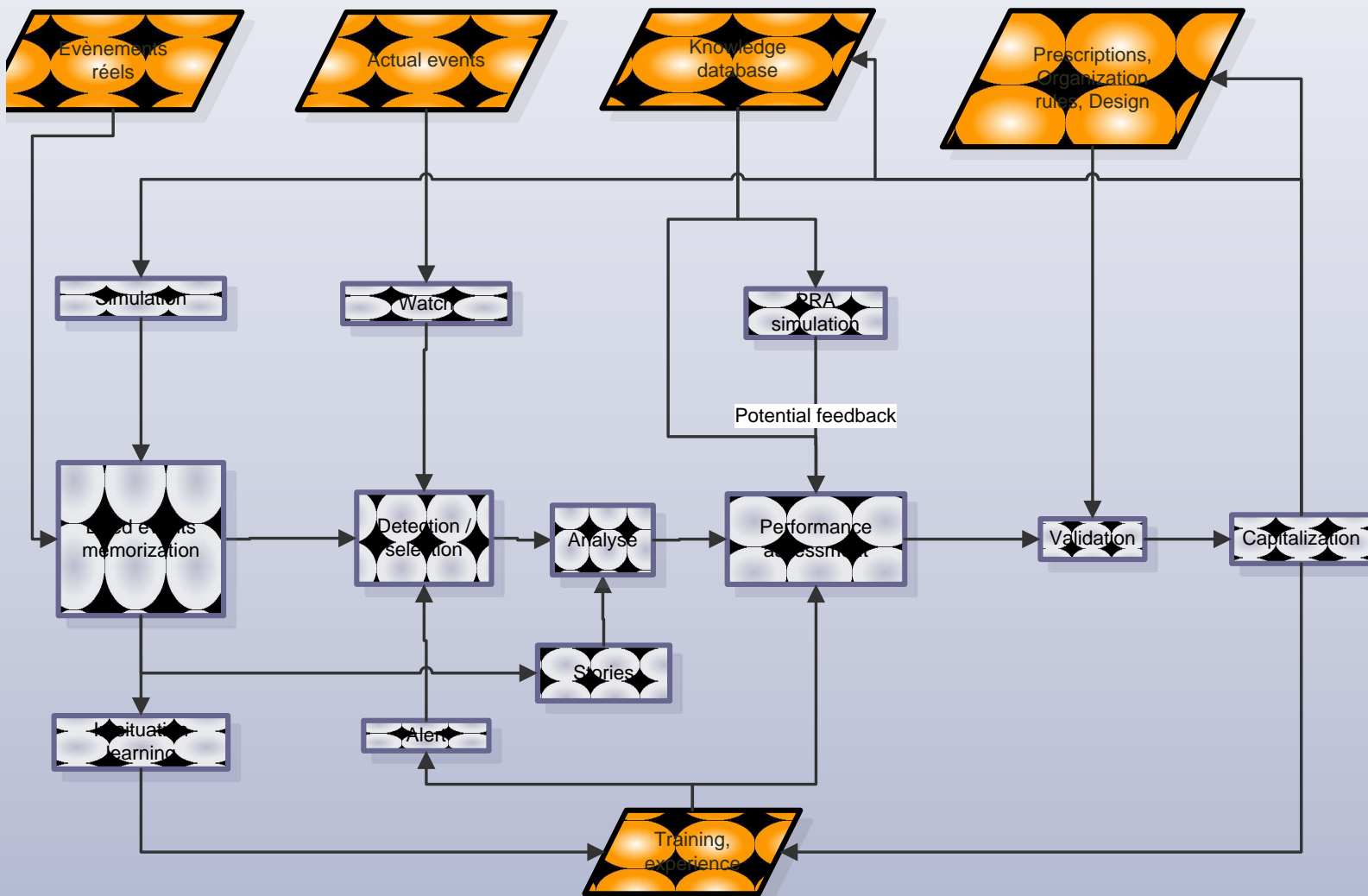
- A and B go alternatively

Context evolves

- Normal traffic on A again: speed increases, drivers stop the new rule
- B continues to go
- Crash
- Surveillance and validation failed



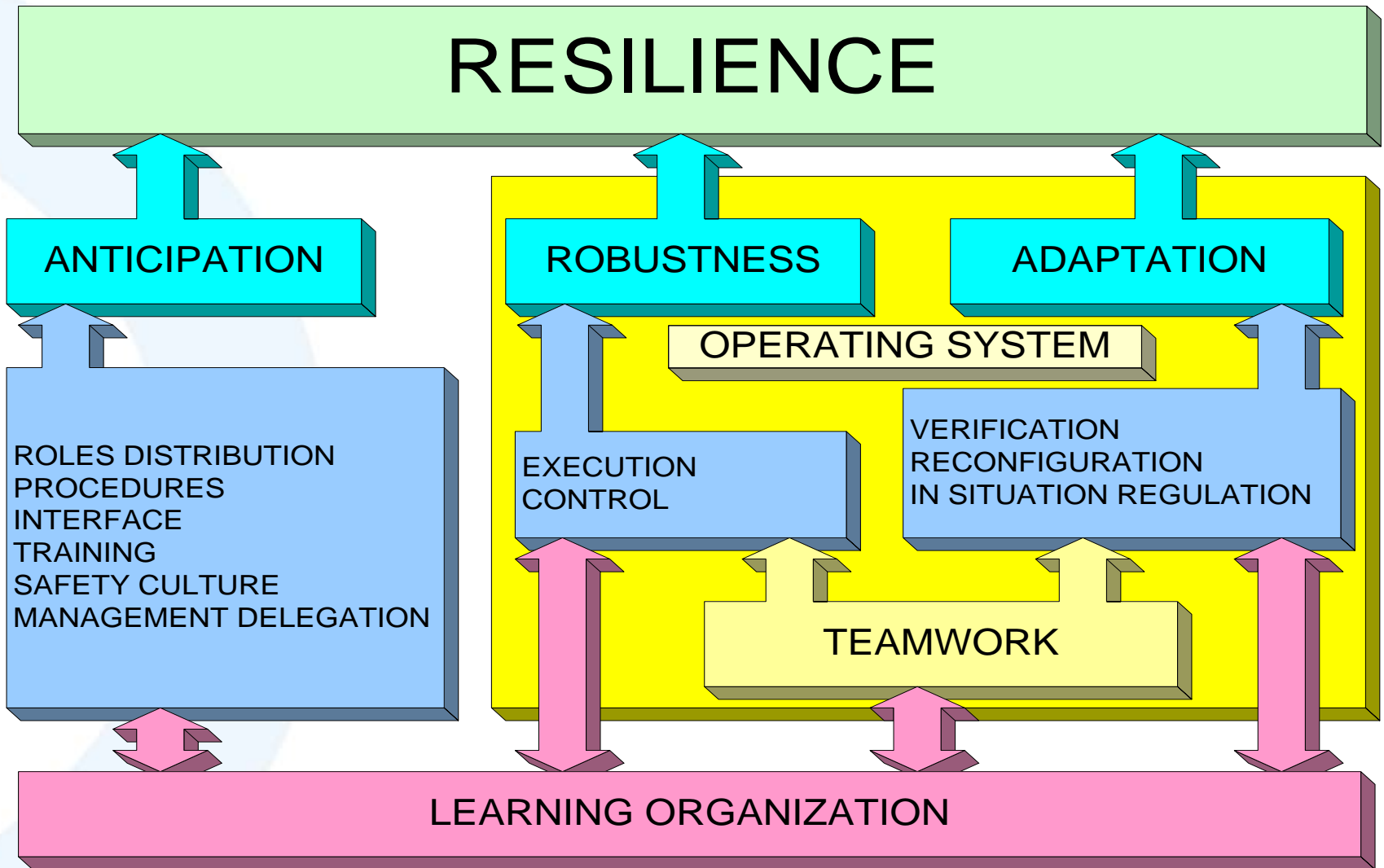
In situation regulation Organizational resources



Differed regulation, learning organization



Model of Resilience in Situation: synthesis

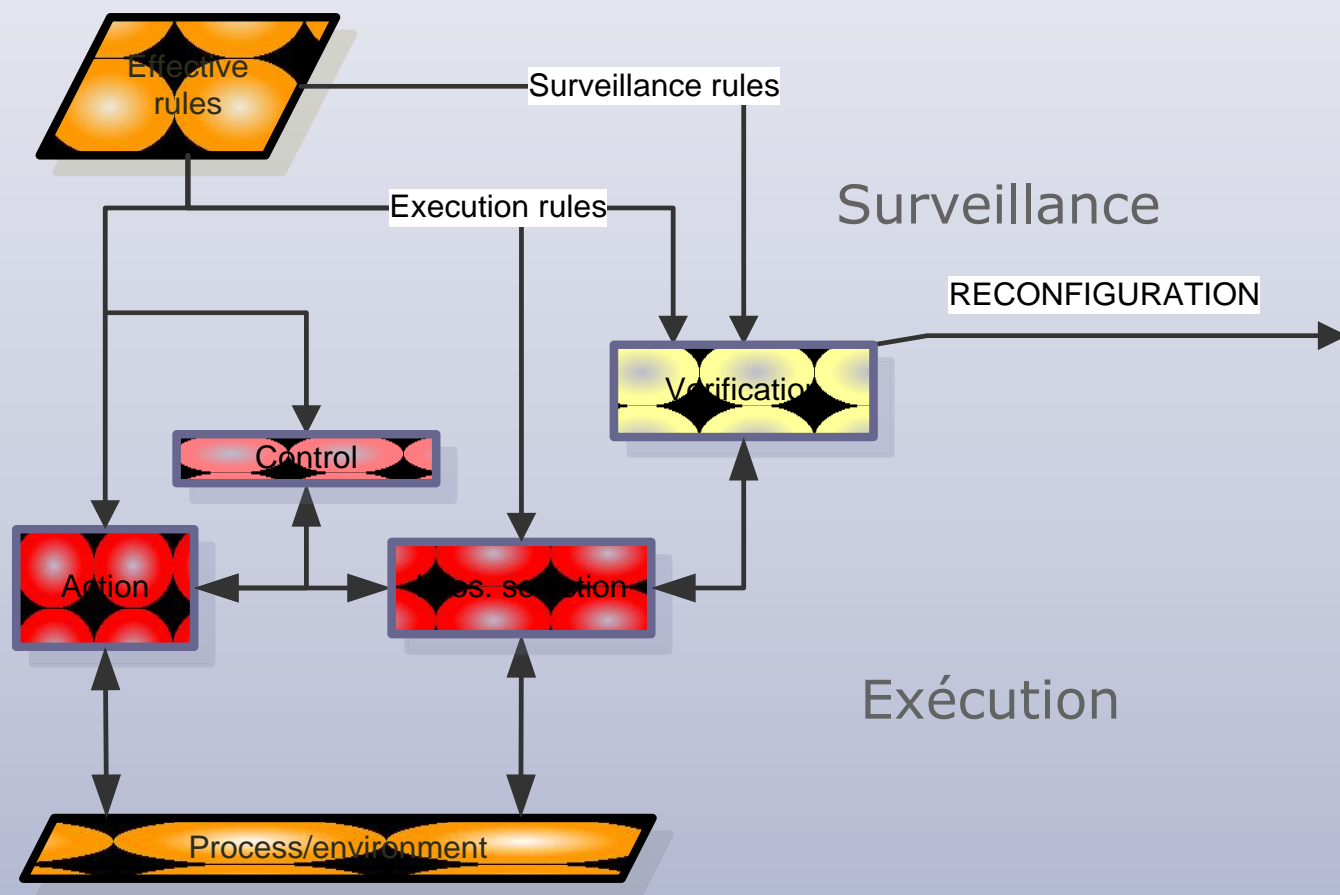


MRS CONTRIBUTION

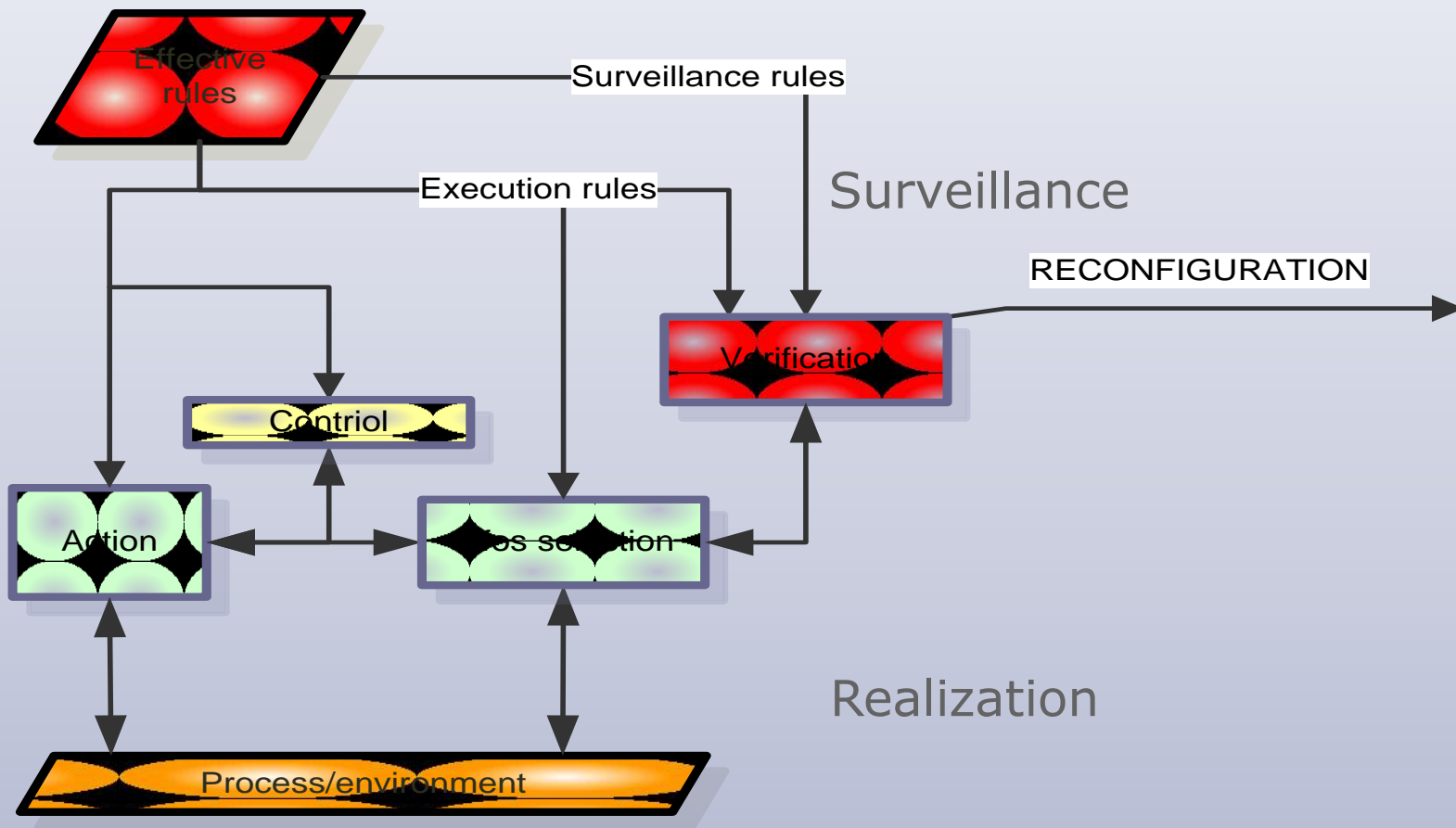


Safety needs ambiguity

- ⊙ Two opposite rationalities: autonomy and control by anticipation
- ⊙ Centralization and decentralization
- ⊙ Stability and rupture
- ⊙ Trust and doubt
- ⊙ ...

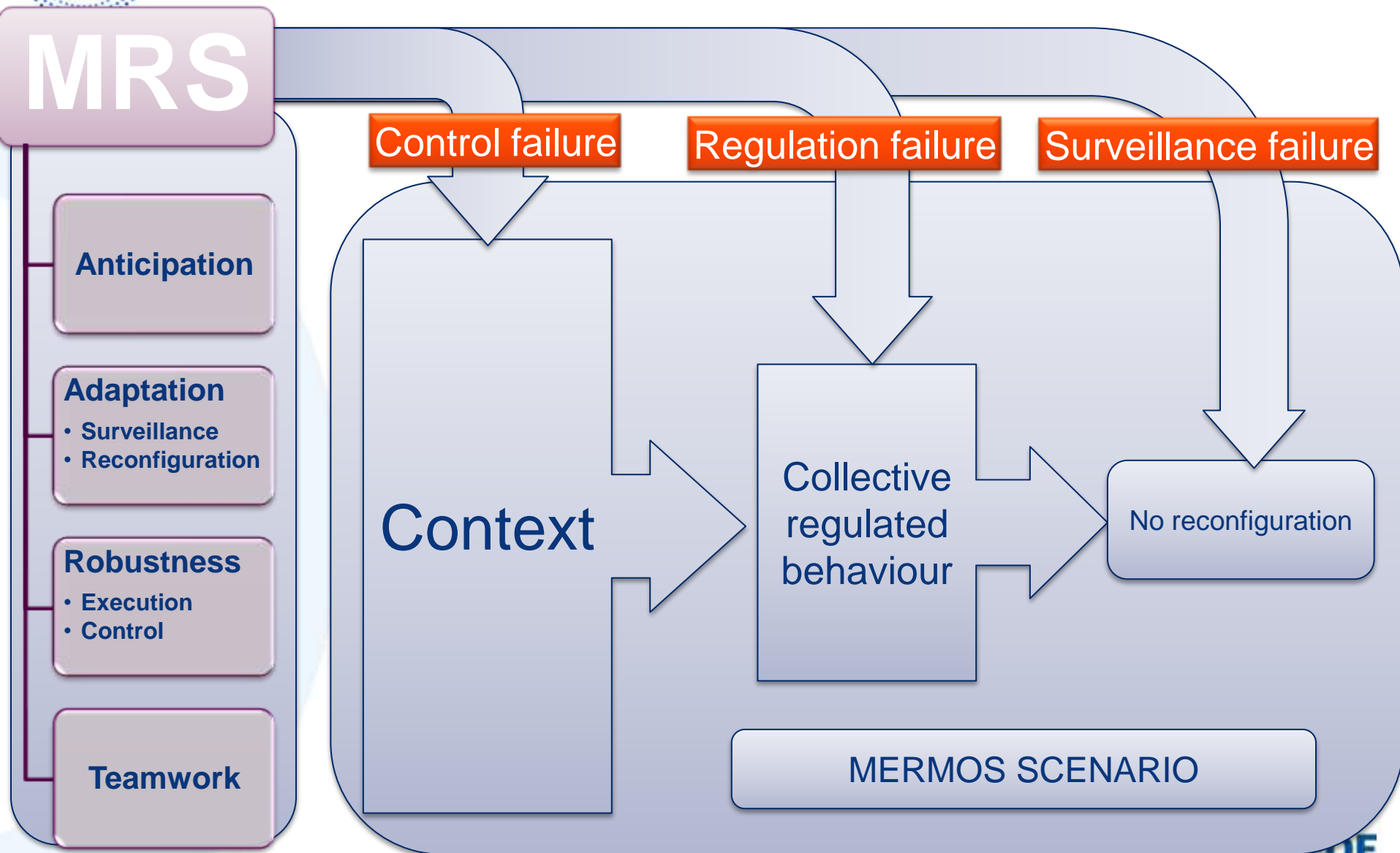


Individual Human error

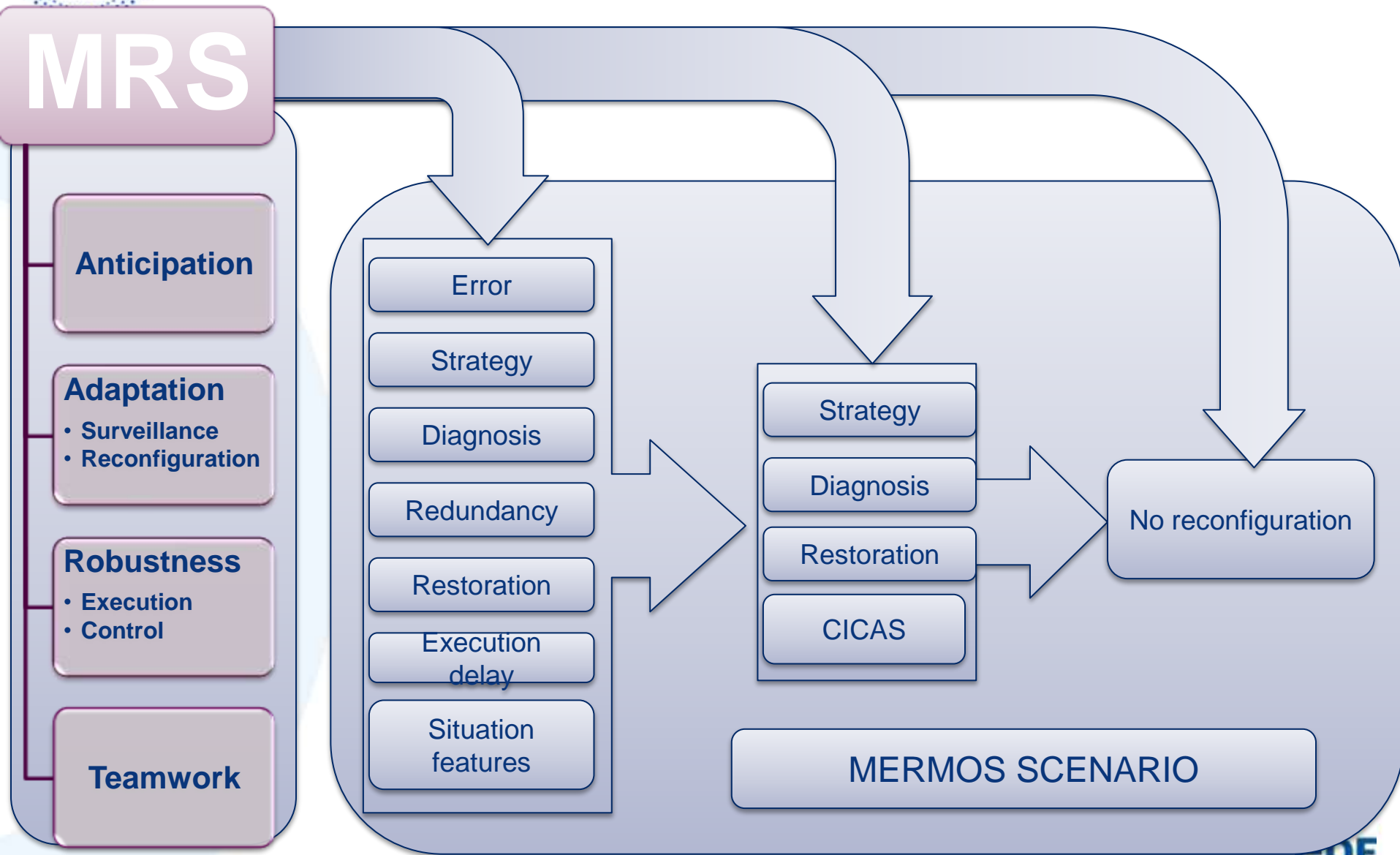


Collective failure

Link between MERMOS and MRS



Delta method





Uses of the MRS

- ⊙ Application to a radiotherapy case: “the Scottish case” (in “Resilience Engineering Perspectives”, Volume 1, “Remaining Sensitive to the Possibility of Failure” edited by E. Hollnagel, C.P. Nemeth, S. Dekker)
- ⊙ Research Study with PSI : EOS questionnaire (see next slides)
- ⊙ MERMOS theoretical support:
 - Application for Halden international benchmark
 - Individual and collective error
 - CICAs = effective rules during stable phase
 - Failure is due to inadequate effective rules without reconfiguration
 - Extension to pre initiator applications human events
- ⊙ Cooperation with ergonomists for control rooms evaluation

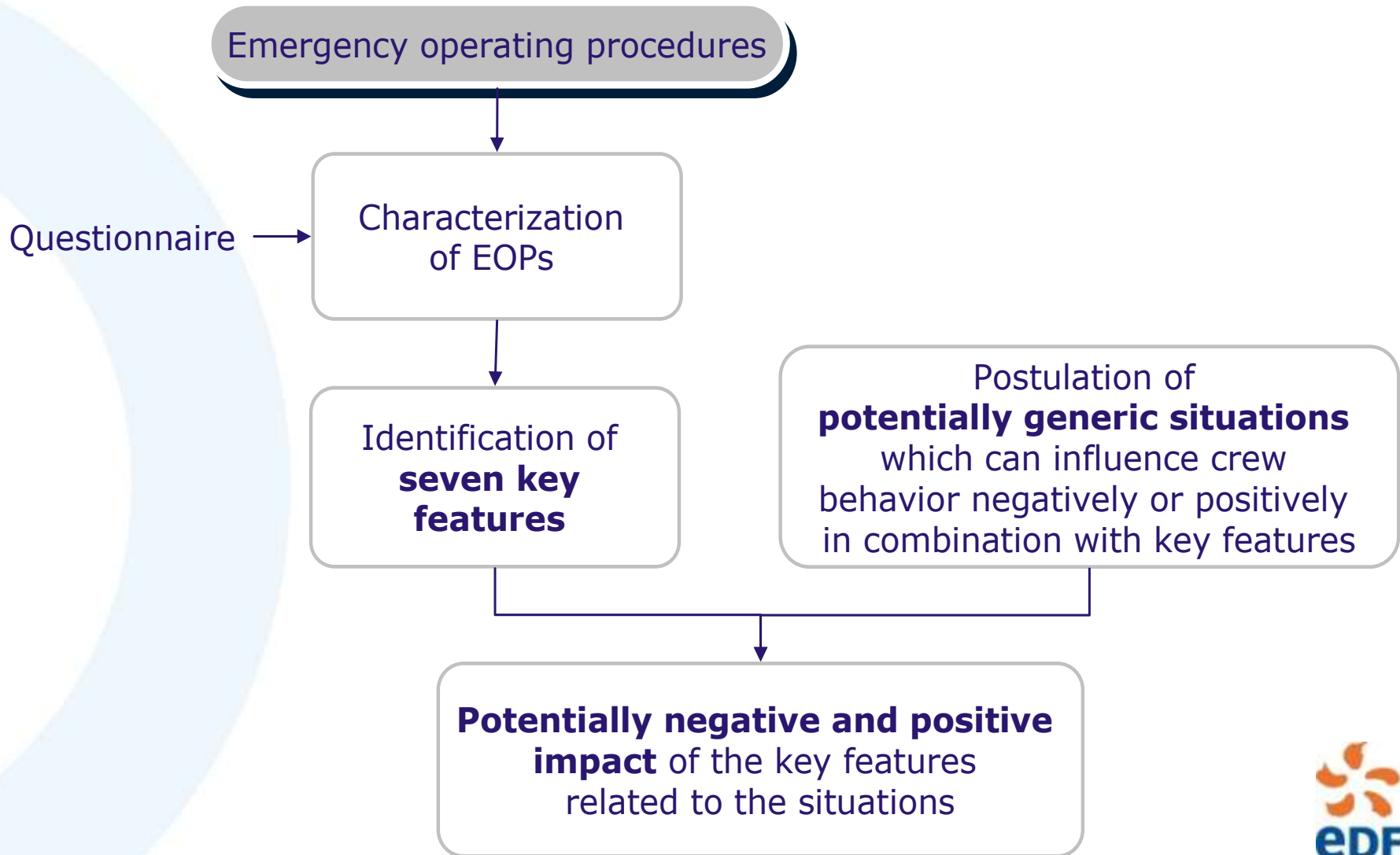


2009/2010 : A Questionnaire to describe EOS (Emergency Operating Systems)

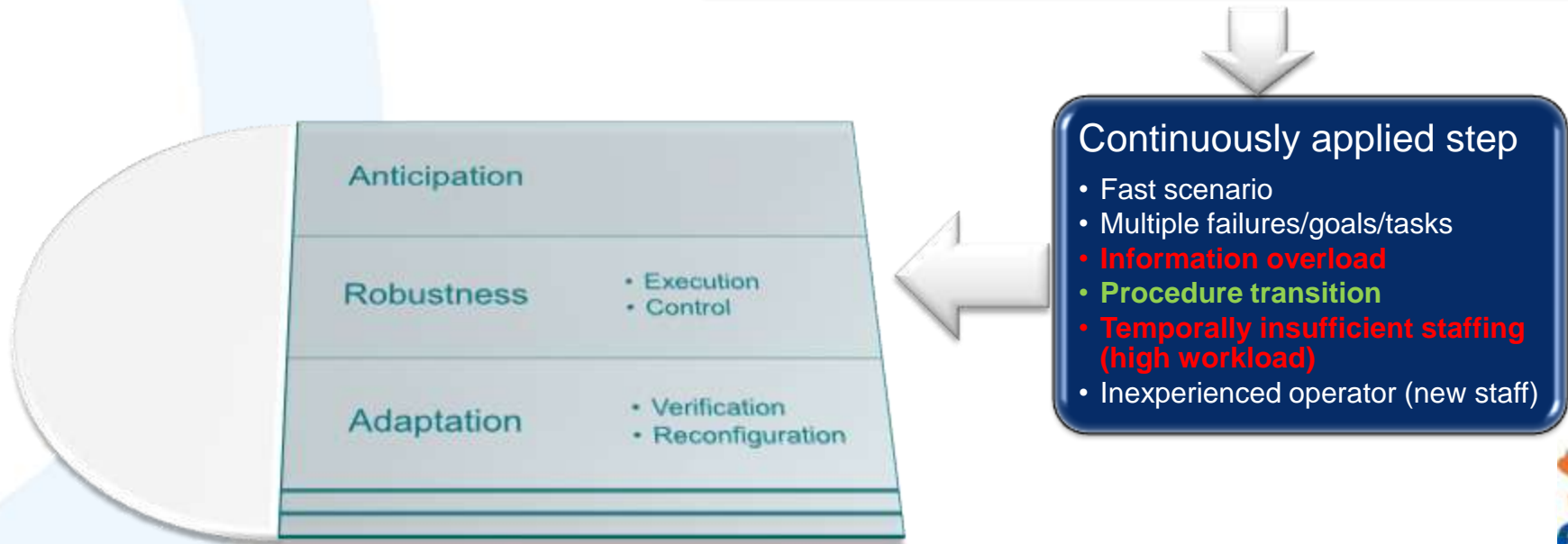
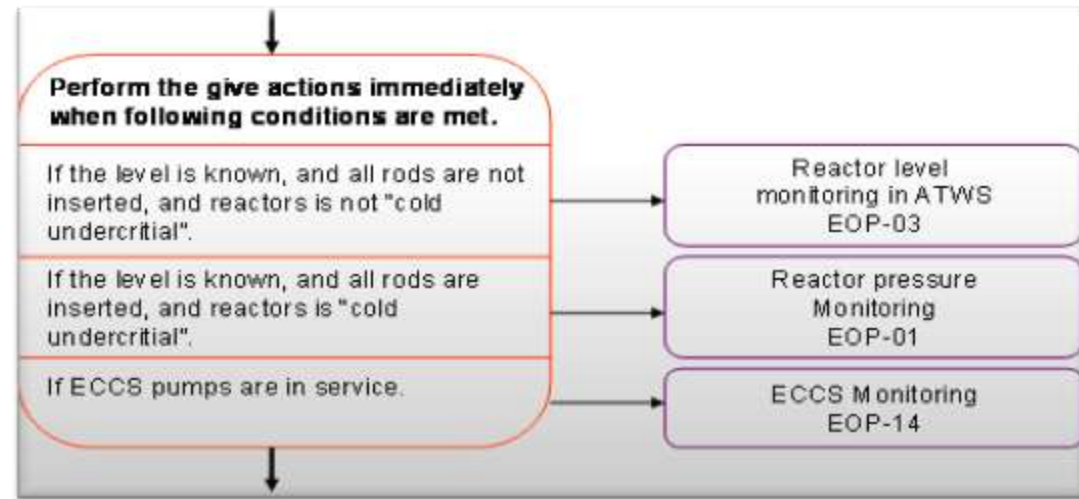
A study begun with the Paul Scherrer Institute
Vinh Dang, Jonghyun Kim, Luca Podofillini

- ◎ Use of the Model of Resilience in Situation (MERMOS)
- ◎ To describe and compare several NPPs EOS from the Human Reliability point of view
 - Description
 - Event analyses
 - Observation on simulator
- ◎ Cooperation or partnerships of other organizations are needed
 - To get information
 - To discuss and share the result

Using the questionnaire: (preliminary) study about a Swiss EOS (1)



Using the questionnaire: (preliminary) study about a Swiss EOS (2)





Issues

⊙ Is the MRS applicable:

- For all organizations ?
- All types of collectives ?
- At the individual collective level ?

⊙ Can it be relevant from Human Sciences approaches' point of view (ergonomics, Sociology, psychology ...) ?



Thank you

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